VIRGINIA MINERALS

COMMONWEALTH OF VIRGINIA
DEPARTMENT OF CONSERVATION AND ECONOMIC DEVELOPMENT
Richmond, Virginia

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RENEWED INTEREST IN HEAVY METALS

A multimillion dollar Federal program is being undertaken by the United States Geological Survey and United States Bureau of Mines to search for and evaluate deposits containing heavy metals. This program is designed to reevaluate known occurrences and to determine and locate new ones. The Geological Survey's "heavy metals" program is an intensified effort to increase the geologic knowledge and resource base of a group of metals that are in short supply. Metals in this group include gold, silver, platinum, palladium, osmium, iridium, mercury, tin, bismuth, antimony, and tantalum. Consumption of all these metals considerably exceeds the domestic production, and known resources of them are small in comparison to the rates of consumption. Industrial consumption of gold per year, for example, is nearly 3 times over domestic production; consumption of silver, exclusive of use in coinage, is more than 3 times the production; consumption of platinum metals is 30 times the production; of mercury, 3 to 4 times. Known domestic resources of most of these metals are equivalent to only a few years' supply at present rates of production. More importantly, many are produced only or principally as byproducts, and hence as resources they are recoverable only at rates determined by the rates of mining of other commodities, such as lead, zinc, copper, and molybdenum.

In the work on heavy metals, the guiding philosophy will be to focus knowledge, imagination, and scientific capability from throughout the broad field of geology or earth science upon the objectives of increased understanding and increased resources of this group of metals. Investigations will be made in the known or conventional environments of the various kinds of deposits, but they will be made also in a search for new kinds of environments, or new kinds of chemical, lithologic, or mineralogic forms. Geologic field investigations will be supplemented by increased analytical capacity, by geochemical and geophysical field surveys of various kinds, by laboratory studies in solution chemistry, mineral systems, rock alteration, and organic-inorganic geochemistry, by investigations of the normal abundance or "background" values in various kinds of rocks, and by drilling or augering for necessary geologic information. The "heavy metals" program will be under the overall supervision of Ogden Tweto, Assistant Chief Geologist for Economic Geology, assisted by Frank S. Simons as Deputy. The bulk of the field investigations will be conducted by the newly created Branch of Heavy Metals, headed by S. C. Creasey. Laboratory experimental work will be conducted principally in the Experimental Geology subactivity, headed by Wayne E. Hall in Washington, D. C.

Currently in Virginia several of the major metal-mining companies are exploring for sulfide ore bodies. The activity is part of a general renewal of interest in the lead, zinc, and copper potential of the Eastern United States. The only production of these materials in Virginia at present is in Wythe County, where The New Jersey Zinc Company is mining lead and zinc ore at Austinville and Ivanhoe.

PLEISTOCENE PELECYPODA OF VIRGINIA[1]

Horace G. Richards[2]

Of the invertebrate fossils found in Pleistocene deposits of Virginia, the great majority belong to the phylum Mollusca, and are about equally divided between the class Pelecypoda (clams) and class Gastropoda (snails). This report lists and figures the pelecypods; it is planned that a future report will be devoted to the gastropods.

Although collecting has been done at various times over many years, rather intensive work was carried out in connection with detailed studies of the Pleistocene of Virginia undertaken by Robert Q. Oaks and Nicholas Coch, while at Yale University. A preliminary report has been published (Oaks and Coch, 1963) and full reports (PhD theses) are on file at Yale University. Reported are fossils obtained from outcrops in Virginia, and from the test borings made in conjunction with the Yale project.

Following is a list of Pleistocene Pelecypoda that are known to occur in Virginia. The distribution during Pleistocene time and also the present distribution are given for each species.

Nucula proxima (Say)
Plate 1, Figure 1
Pleistocene distribution: New York to Florida
Present distribution: Nova Scotia to Texas

Nuculana acuta (Conrad)
Plate 1, Figure 2
Pleistocene distribution: Maryland to Florida and Texas
Present distribution: Massachusetts to West Indies and Texas

Yoldia limatula (Say)
Plate 1, Figure 3
Pleistocene distribution: Quebec to South Carolina
Present distribution: Gulf of St. Lawrence to North Carolina

Anadara ovalis Bruguiere
(*Arca campechiensis* Gmelin)
Plate 1, Figures 4, 5
Pleistocene distribution: Massachusetts to South Carolina
Present distribution: Massachusetts to West Indies and Gulf States

Anadara transversa (Say)
(*Arca transversa* Say)
Plate 1, Figures 6, 7
Pleistocene distribution: Massachusetts to North Carolina
Present distribution: Massachusetts to Texas

Noetia ponderosa (Say)
(*Arca ponderosa* Say)
Plate 1, Figure 8
Pleistocene distribution: Massachusetts to Georgia

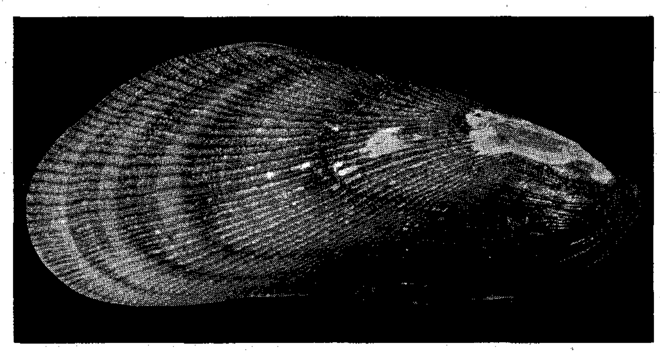


Figure 1. **Modiolus demissus** (Dillwyn) (Recent)

[1]/ Aided by Grant NONR (G) 00027 (66) and previous grants from the Office of Naval Research.

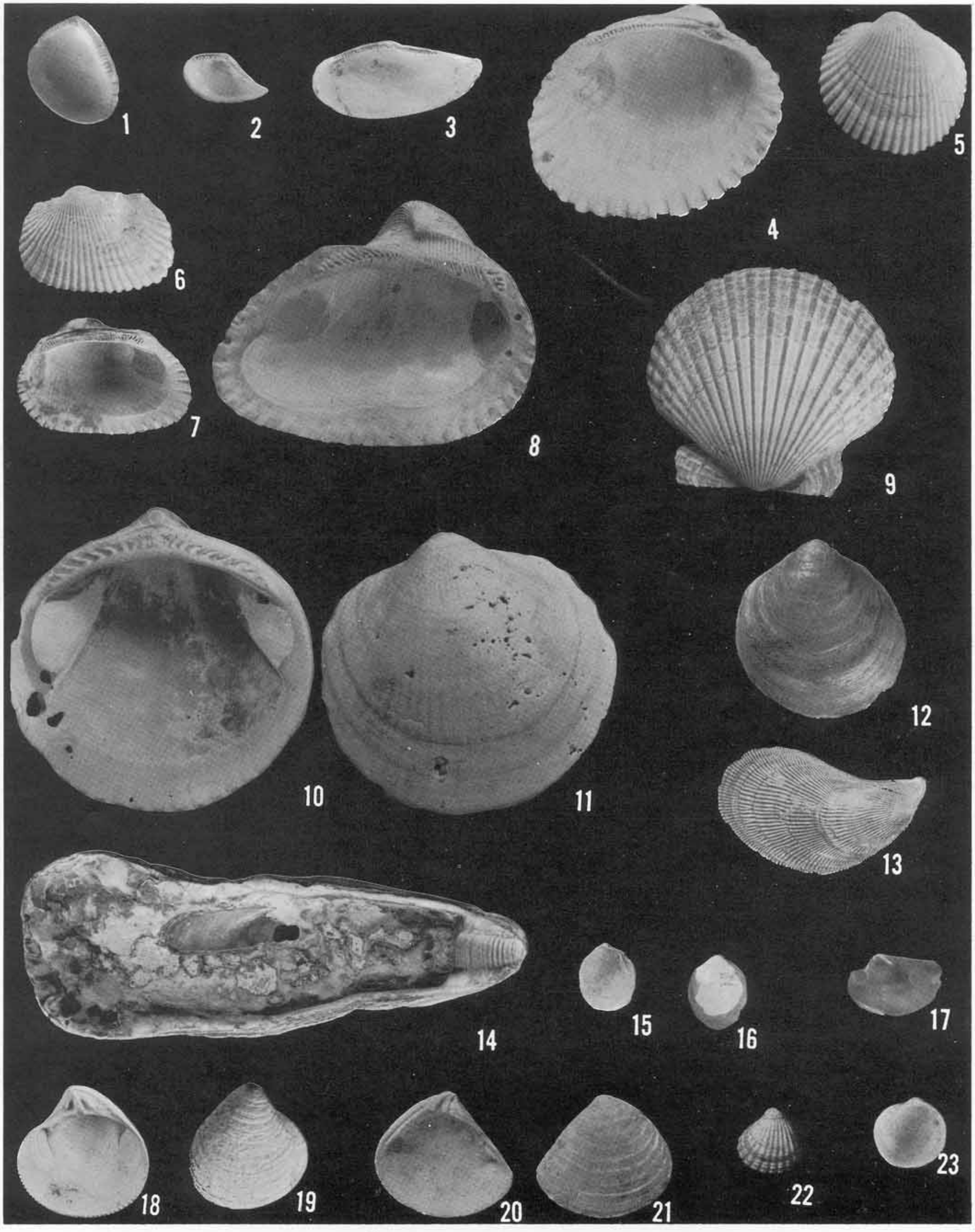
[2]/ Academy of Natural Sciences of Philadelphia, Philadelphia, Pennsylvania.

EXPLANATION OF PLATE 1

Figure	
1	*Nucula proxima* (Say) X 3
2	*Nuculana acuta* (Conrad) X 5
3	*Yoldia limatula* (Say)
4, 5	*Anadara ovalis* Bruguiere
6, 7	*Anadara transversa* (Say)
8	*Noetia ponderosa* (Say)
9	*Pecten irradians* Lamarck
10, 11	*Glycymeris americana* (DeFrance)
12	*Anomia simplex* d'Orbigny
13	*Brachydontes recurvus* (Rafinesque) (Recent)
14	*Crassostrea virginica* (Gmelin)
15, 16	*Crenella glandula* Totten
17	*Pandora trilineata* Say
18, 19	*Astarte castanea* (Say)
20, 21	*Crassinella lunulata* (Conrad) X 2½
22	*Venericardia tridentata* Say X 2
23	*Lucina multilineata* Tuomey and Holmes X 3

All specimens figured are Pleistocene and natural size unless otherwise indicated.

PLATE 1



Present distribution: Virginia to Gulf of Mexico

Glycymeris americana (DeFrance)
Plate 1, Figures 10, 11
Pleistocene distribution: Virginia to Florida
Present distribution: North Carolina to West Indies and Texas

Crassostrea virginica (Gmelin)
(*Ostrea virginica* Gmelin)
Plate 1, Figure 14
Pleistocene distribution: Massachusetts to Florida and Texas
Present distribution: Gulf of St. Lawrence to Gulf of Mexico and West Indies

Anomia simplex d'Orbigny
Plate 1, Figure 12
Pleistocene distribution: Massachusetts to South Carolina
Present distribution: Nova Scotia to West Indies

Modiolus demissus (Dillwyn)
Text Figure 1
Pleistocene distribution: New Jersey to South Carolina
Present distribution: Gulf of St. Lawrence to South Carolina

Brachydontes recurvus (Rafinesque)
(*Mytilus recurvus* Rafinesque)
Plate 1, Figure 13
Pleistocene distribution: Massachusetts to North Carolina
Present distribution: Cape Cod to Texas and West Indies

Crenella glandula Totten
Plate 1, Figures 15, 16
Pleistocene distribution: Quebec (?) to Virginia
Present distribution: Labrador to North Carolina

Pandora trilineata Say
Plate 1, Figure 17
Pleistocene distribution: New Jersey to South Carolina
Present distribution: North Carolina to Texas

Astarte castanea (Say)
Plate 1, Figures 18, 19
Pleistocene distribution: Massachusetts to Virginia
Present distribution: Nova Scotia to North Carolina

Crassinella lunulata (Conrad)
Plate 1, Figures 20, 21
Pleistocene distribution: Massachusetts to South Carolina
Present distribution: Massachusetts to West Indies

Venericardia tridentata Say
Plate 1, Figure 22
Pleistocene distribution: New Jersey to South Carolina
Present distribution: North Carolina to Florida and Gulf of Mexico

Venericardia borealis (Conrad)
Plate 2, Figures 1, 2
Pleistocene distribution: Labrador to Virginia
Present distribution: Labrador to North Carolina (deep water from New Jersey southward)

Phacoides crenella Dall
Plate 2, Figures 3, 4
Pleistocene distribution: Virginia to South Carolina
Present distribution: Virginia to Cuba

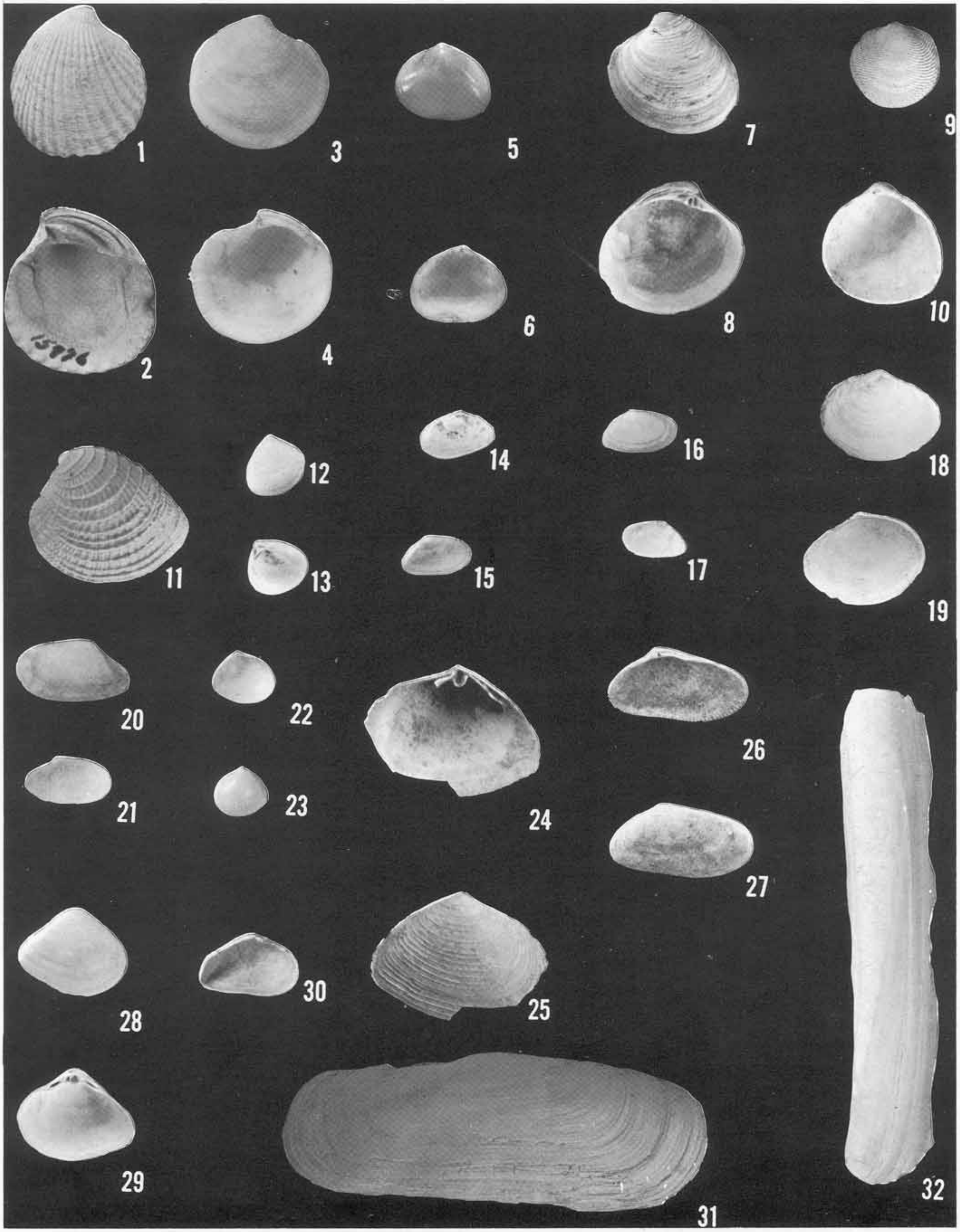
EXPLANATION OF PLATE 2

Figure	
1, 2	*Venericardia borealis* (Conrad)
3, 4	*Phacoides crenella* Dall X 2
5, 6	*Bornia longipes* (Stimpson) X 2
7, 8	*Pitar morrhuana* (Linsley)
9	*Divaricella quadrisulcata* d'Orbigny
10	*Laevicardium mortoni* (Conrad)
11	*Chione cancellata* (Linné)
12, 13	*Gemma gemma* Totten X 4
14, 15	*Tellina agilis* Stimpson
16, 17	*Tellina texana* Dall

Figure	
18, 19	*Macoma balthica* (Linné)
20, 21	*Macoma tenta* (Say)
22, 23	*Abra aequalis* (Say)
24, 25	*Cumingia tellinoides* (Conrad) X 2
26, 27	*Donax variabilis* Say
28, 29	*Mulinia lateralis* (Say)
30	*Corbula contracta* Say X 2
31	*Tagelus gibbus* (Spengler)
32	*Ensis directus* (Conrad)

All specimens figured are Pleistocene and natural size unless otherwise indicated.

PLATE 2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Lucina multilineata Tuomey and Holmes
Plate 1, Figure 23
Pleistocene distribution: Maryland to South Carolina
Present distribution: North Carolina to Florida (both coasts)

Divaricella quadrisulcata d'Orbigny
Plate 2, Figure 9
Pleistocene distribution: New Jersey to South Carolina
Present distribution: Massachusetts to Brazil

Bornia longipes (Stimpson)
Plate 2, Figures 5, 6
Pleistocene distribution: Virginia
Present distribution: North and South Carolina

Laevicardium mortoni (Conrad)
(*Cardium mortoni* Conrad)
Plate 2, Figure 10
Pleistocene distribution: New Jersey to South Carolina
Present distribution: Nova Scotia to Texas

Pitar morrhuana (Linsley)
Plate 2, Figures 7, 8
Pleistocene distribution: New York to North Carolina
Present distribution: Gulf of St. Lawrence to North Carolina

Chione cancellata (Linné)
Plate 2, Figure 11
Pleistocene distribution: Virginia to Florida
Present distribution: North Carolina to Brazil

Gemma gemma (Totten)
Plate 2, Figures 12, 13
Pleistocene distribution: Massachusetts to Alabama
Present distribution: Nova Scotia to Texas and Bahamas; Puget Sound to Washington

Mercenaria mercenaria (Linné)
(*Venus mercenaria* Linné)
Plate 3, Figure 3
Pleistocene distribution: Massachusetts to Georgia
Present distribution: Gulf of St. Lawrence to Gulf of Mexico

Mercenaria campechiensis (Gmelin)
Plate 3, Figures 1, 2
Pleistocene distribution: New York to South Carolina
Present distribution: New Jersey to Texas and Gulf of Mexico

Tellina agilis Stimpson
(*Tellina tenera* Say)
Plate 2, Figures 14, 15
Pleistocene distribution: Massachusetts to South Carolina
Present distribution: Gulf of St. Lawrence to Gulf of Mexico

Tellina texana Dall
Plate 2, Figures 16, 17
Pleistocene distribution: Virginia to South Carolina
Present distribution: North Carolina to Florida and Cuba; Gulf of Mexico

Macoma balthica (Linné)
Plate 2, Figures 18, 19
Pleistocene distribution: James Bay to South Carolina
Present distribution: Arctic to Georgia; Bering Sea to off Monterey, California

Macoma tenta (Say)
Plate 2, Figures 20, 21
Pleistocene distribution: Virginia and South Carolina
Present distribution: Maine to Florida and West Indies

Abra aequalis (Say)
Plate 2, Figures 22, 23
Pleistocene distribution: New York to South Carolina
Present distribution: Connecticut to West Indies

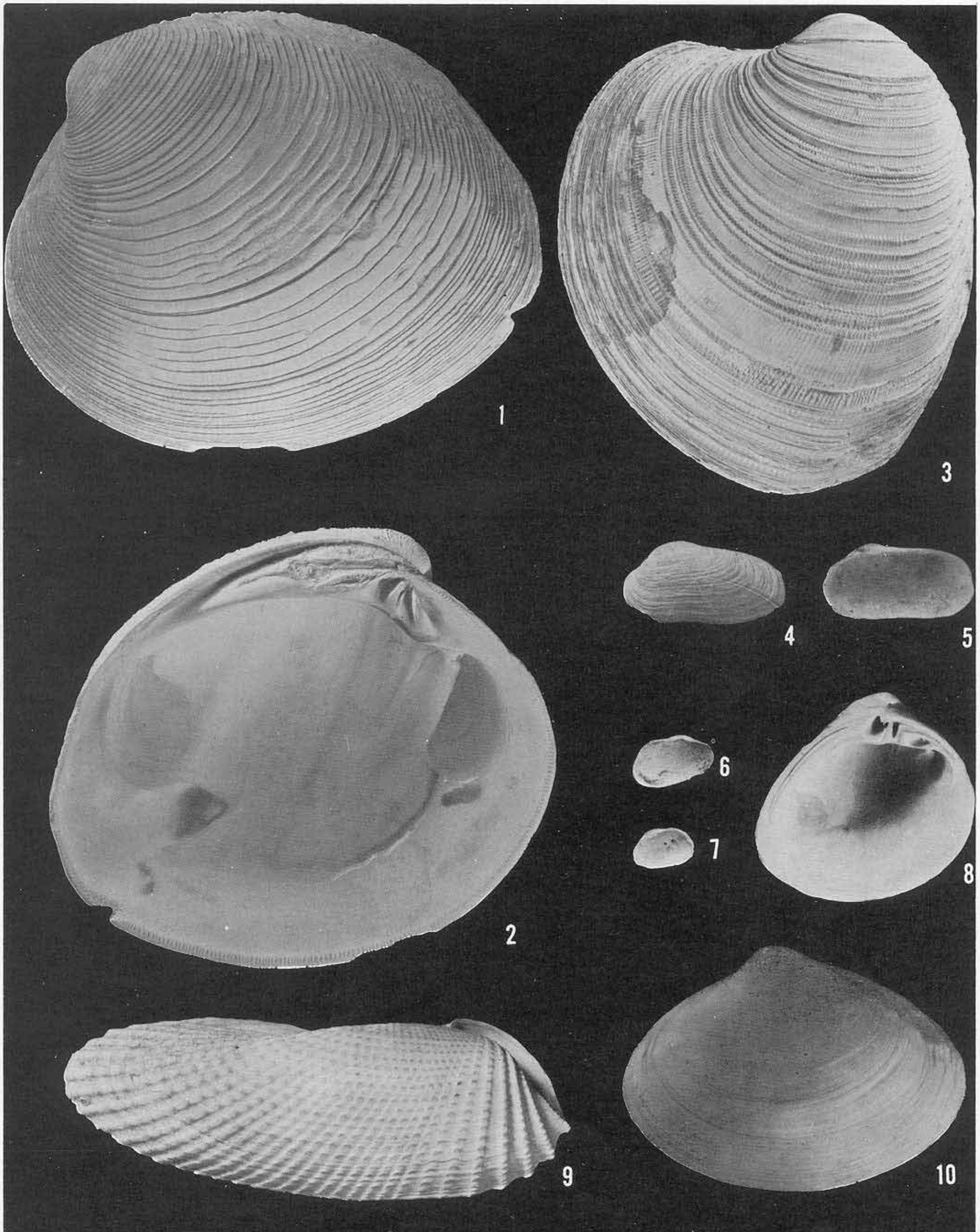
Cumingia tellinoides (Conrad)
Plate 2, Figures 24, 25

EXPLANATION OF PLATE 3

Figure		Figure	
1, 2	*Mercenaria campechiensis* (Gmelin)	8	*Rangia cuneata* (Gray)
3	*Mercenaria mercenaria* (Linné)	9	*Barnea costata* (Linné) (Recent)
4-7	*Hiatella arctica* (Linné)	10	*Spisula soladissima* (Dillwyn)

All specimens figured are Pleistocene and natural size unless otherwise indicated.

PLATE 3



Pleistocene distribution: Massachusetts to South Carolina
Present distribution: Nova Scotia to Florida

Donax variabilis Say
Plate 2, Figures 26, 27
Pleistocene distribution: Virginia to Georgia
Present distribution: Virginia to Texas

Corbula contracta Say
Plate 2, Figure 30
Pleistocene distribution: New Jersey to North Carolina
Present distribution: Massachusetts to West Indies

Ensis directus (Conrad)
Plate 2, Figure 32
Pleistocene distribution: Maine to Florida and Louisiana
Present distribution: Labrador to Florida

Tagelus gibbus (Spengler)
Plate 2, Figure 31
Pleistocene distribution: New York to South Carolina
Present distribution: Massachusetts to Florida and Texas

Spisula soladissima (Dillwyn)
Plate 3, Figure 10
Pleistocene distribution: Maine to South Carolina
Present distribution: Labrador to Gulf of Mexico

Mulinia lateralis (Say)
Plate 2, Figures 28, 29
Pleistocene distribution: New York to South Carolina
Present distribution: Massachusetts to Florida and Texas

Rangia cuneata (Gray)
Plate 3, Figure 8
Pleistocene distribution: New Jersey to South Carolina; Gulf Coast
Present distribution: Northwest Florida to Mexico; rare along Atlantic Coast north to Virginia

Hiatella arctica (Linné)
(*Saxicava arctica* Linné)
Plate 3, Figures 4-7
Pleistocene distribution: Hudson Bay to North Carolina
Present distribution: Arctic to West Indies (in deep water south of Maine); Arctic to off Panama (deep water)

Barnea costata (Linné)
(*Pholas costata* Linné)
Plate 3, Figure 9
Pleistocene distribution: Delaware to South Carolina
Present distribution: Massachusetts to Texas and West Indies

Pecten irradians Lamarck
Plate 1, Figure 9
No actual records from Pleistocene of Virginia, but common in Pleistocene deposits both to the north and south
Pleistocene distribution: New York to South Carolina
Present distribution: Nova Scotia to Texas and West Indies

REFERENCE

Oaks, R. Q., and Coch, N. K., 1963, Pleistocene sea levels, southeastern Virginia: Science, vol. 140, p. 979-983.

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NEW PUBLICATIONS

Bulletin 80. GEOLOGY AND MINERAL RESOURCES OF FREDERICK COUNTY, by Charles Butts and Raymond S. Edmundson; 142 p., with geologic map in color.

Price: $4.00

Frederick County occupies about 433 square miles in northern Virginia and lies wholly within the Valley and Ridge province of the Appalachian Highlands. Southeast of Little North Mountain is a broad lowland, a segment of Shenandoah Valley, which is underlain by Cambrian and Ordovician limestone and shale. The northwestern part of the county is characterized by northeastward-trending ridges, some of large size, and intervening valleys. Here the exposed strata, ranging in age from Late Ordovician to Early Mississippian, consist mainly of sandstone and shale with minor amounts of limestone. The aggregate thickness of the sedimentary sequence is estimated at 22,000 feet.

The present attitude of the rocks is related to late Paleozoic orogeny. In the eastern part of the county the symmetry of the folds in response to the compressive forces from the east is shown by the oversteepened and locally overturned east limbs of synclines and west limbs of anticlines, and by the easterly dip of the thrust faults that cut some of the major folds. To the northwest faults are less common, and the folds are more open and less overturned. Minor folding, faulting, and cleavage are well displayed in a few exposures of incompetent soft shales and thin-bedded limestones and sandstones.

In the past, manganese ore and iron ore have been mined in Frederick County. Mineral resources of economic importance which are being produced and processed at the present time include limestone and dolomite, silica sand, and clay and shale.

Information Circular 11. DIRECTORY OF THE MINERAL INDUSTRY IN VIRGINIA—1966, by D. C. LeVan and R. F. Pharr; 38 p. Price: $0.25

This directory lists the names and addresses of 239 producers and processors of rock and mineral materials in Virginia, exclusive of coal, on record as of February 1, 1966. The listing includes some captive and intermittent operations, and some processors of out-of-State or imported materials. The names of producers and processors are arranged by raw material or commodity under the appropriate county or city. An alphabetical listing of the names of companies and individuals is provided as a convenient reference index.

Information Circular 12. MAGNETIC AND RADIOMETRIC DATA, SOUTHWEST PIEDMONT OF VIRGINIA; 1 p., with 4 maps. Price: $1.50

Between May 28 and June 23, 1965, an airborne magnetic and radiometric survey was flown over an area of nearly 1700 square miles across parts of Carroll, Floyd, Franklin, Grayson, Henry, Patrick, and Wythe counties. The traverse flight direction was N. 45° W. and S. 45° E.; tie line direction was at right angles to the traverse direction. Distance between adjacent traverses was 0.5 mile; flight altitude, 500 feet above terrain; and speed of the aircraft, about 150 miles per hour.

Total magnetic intensity contoured at 10 and 20 gammas and radiometric data contoured at 300 counts per second are delineated on the accompanying plates. The data were compiled to provide basic information for the interpretation of the geology and evaluation of mineral occurrences in the southwestern Piedmont of Virginia.

Report of Investigations 7. GEOLOGY OF THE VESUVIUS QUADRANGLE, VIRGINIA, by H. J. Werner; 53 p., with geologic map in color. Price: $1.75

In the Vesuvius quadrangle of central Virginia the Precambrian Virginia Blue Ridge Complex composed of granitic and gneissic rocks is uncomformably overlain by a succession of Cambrian and Ordovician volcanic and sedimentary rocks that are exposed in the northwest limb of the Blue Ridge-Catoctin Mountain anticlinorium. The Lower Cambrian formations consist of coarse graywackes, arkoses, subgraywackes, altered basalt flows commonly referred to as greenstones, and quartzose sandstones which are conformably overlain by Upper Cambrian and Lower Ordovician shales, limestones, and dolomites. Field relationships indicate that the Lower Cambrian formations were deposited on an eroded and weathered Precambrian surface that had an original easterly gradient. These relationships and the continuity of the stratigraphic succession indicate essentially uninterrupted deposition from the beginning of Cambrian time and extending well into Ordovician time. None of the numerous faults in the quadrangle is interpreted to be sufficiently large to cast doubt on the nature of the stratigraphic succession. Thus, the stratigraphic succession in the Vesuvius quadrangle in the northwest limb of the Blue Ridge-Catoctin Mountain anticlinorium can be related to the formations that occur in the southeast limb of the anticlinorium. These relationships provide a record of the change from a eugeosynclinal to a miogeosynclinal depositional environment from Early Cambrian to Early Ordovician time.

The time of the structural deformation of the Cambrian and Ordovician rocks is uncertain. There is no lithologic evidence to indicate tectonism within the central Virginia region before Middle Ordovician time.

Although the mineral resources of the Vesuvius quadrangle are not of great economic potential, iron, manganese, and tin ores have been mined at various times; and crushed stone, sand, and gravel are presently being produced.

Report of Investigations 9. MIOCENE AND PLEISTOCENE FORAMINIFERA AND OSTRACODA OF SOUTHEASTERN VIRGINIA, by James D. McLean, Jr.; 202 p., 23 fossil plates. Price: $2.00

A review of the known stratigraphic ranges and ecologies of Foraminifera and Ostracoda from the Virginia-Maryland Pleistocene and Miocene sediments is incorporated into a study of well sections and outcrop samples to determine the Pleistocene-Miocene contacts in southeastern Virginia. Occurrences of microfossils are plotted for all samples studied and lithologies are given for well sections. Several species are reported from outcrops of the Yorktown Formation that have not previously been noted. In the Chesapeake Bay subsurface, the Yorktown is found to have been planed off, leaving a contact between the Pleistocene and the St. Marys (Miocene), with a remarkable uniformity of thickness for the St. Marys Formation of about 50 feet. Redeposition of Miocene forms in the Pleistocene is discussed, and the value of *Elphidium florentinae* as a local guide for the Pleistocene is indicated. The following new forms are named: *Lagena pageae*, n. sp.; *Entosolenia bifida*, n. sp.; *Nodosaria catesbyi* subsp. *hustonae*, n. subsp.; and *Bulimina gracilis* subsp. *calveri*, n. subsp.

The following comments were received after the recent distribution of Bulletin 80, Report of Investigations 9, and Information Circular 12.

"These are substantial and basic contributions to the geology of Virginia."

— Arthur C. Munyan, Chairman
Department of Geology
Old Dominion College
Norfolk, Virginia

"All of them will be useful, and are significant contributions to the literature on geology of Virginia."

— Robert A. Laurence
Branch of Resources Research
U. S. Geological Survey
Knoxville, Tennessee

"They are invaluable, particularly to regional prospectors and railroad geologists."

— Norman K. Olson
General Industrial Geologist
Southern Railway System
Atlanta, Georgia

"The study ['Geology and Mineral Resources of Frederick County'] impresses me as being well done and I find it something of a relief in reading a bulletin to discover that I can understand what the authors are saying."

— Robert J. Harris, Dean
The Faculty of Arts and Sciences
University of Virginia
Charlottesville, Virginia

NEWS NOTES

The Vulcan Materials Company of Birmingham, Alabama, adopted new names on May 1, 1966, for the company's eight operating divisions, two of which operate rock quarries in Virginia for the production of crushed stone. The former W. E. Graham and Sons Division, which has quarries in Augusta, Brunswick, Fairfax, Goochland, Halifax, Mecklenburg, Pittsylvania, Prince William, and Rockingham counties, is now known as Vulcan Materials Company, Mideast Division, with offices in Winston-Salem, North Carolina. The former Lambert Brothers Division, which has quarries in Alleghany, Rockbridge, and Washington counties is now Vulcan Materials Company, Midsouth Division, with offices in Knoxville, Tennessee.

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ADDITION TO STAFF

Dr. Gary C. Allen joined the Division on July 1, 1966, and will direct some petrologic and mineralogic studies and be in charge of geochemical investigations. He received a B.S. degree in chemistry from Stanford University in 1961, an M.A. degree in geology from Rice University in 1963, and has recently completed his Ph.D. degree in geochemistry at the University of North Carolina. He is married.

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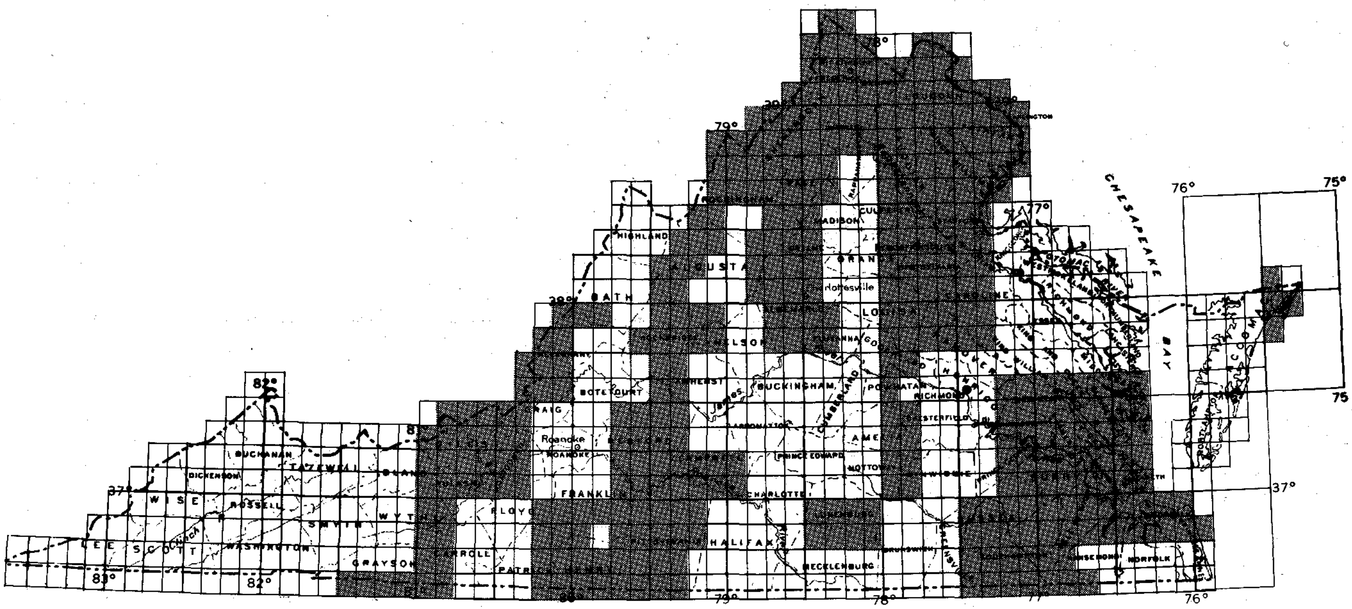
PROGRESS OF TOPOGRAPHIC MAPPING

The following compilation and maps indicate the progress of the topographic mapping program in Virginia through June 30, 1966.

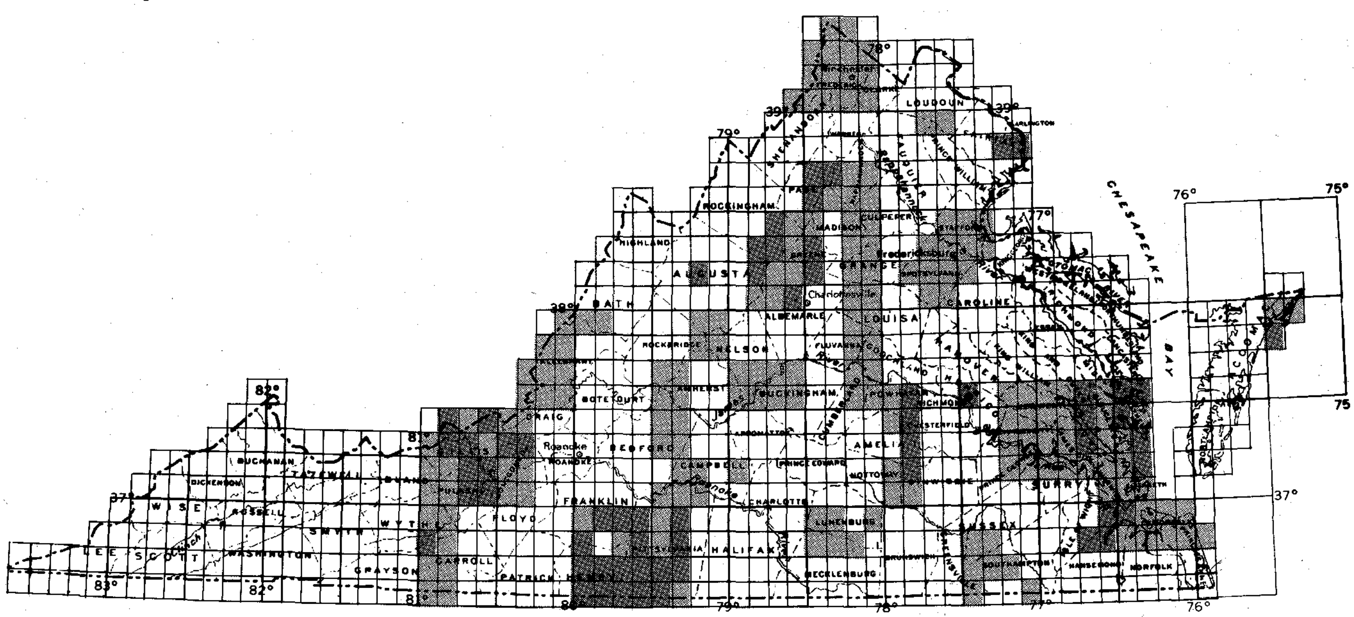
	No. of Quadrangles	Percent of State
Total number of 7.5′ quadrangles	807	100
Number of 7.5′ quadrangles in progress	438	54.3
Number of 7.5′ quadrangles of recent aerial photography	508	64
Number of 7.5′ stereo-compilations	181	22.3
Number of 7.5′ composites	60	7.4
Number of 7.5′ published modern maps 7/1/65 to 6/30/66	39	4.8
Number of 7.5′ published modern maps	204	25.3
Total number of 7.5′ stero-compilations, composites, and published maps	445	55.1



Shading indicates areas where some phase of topographic mapping was in progress as of June 30, 1966.

ADVANCE MAPS

- Stereocompilations
- Composites



Areas where advance maps are available. Stereocompilations are advance maps that have not been field checked and have no names. Composites are advance maps that have been field checked and have names. Advance prints (blue line) of topographic maps are available at 50 cents each from the U. S. Geological Survey, Topographic Division, 1109 N. Highland St., Arlington, Va. 22210.

Virginia

Division of Mineral Resources

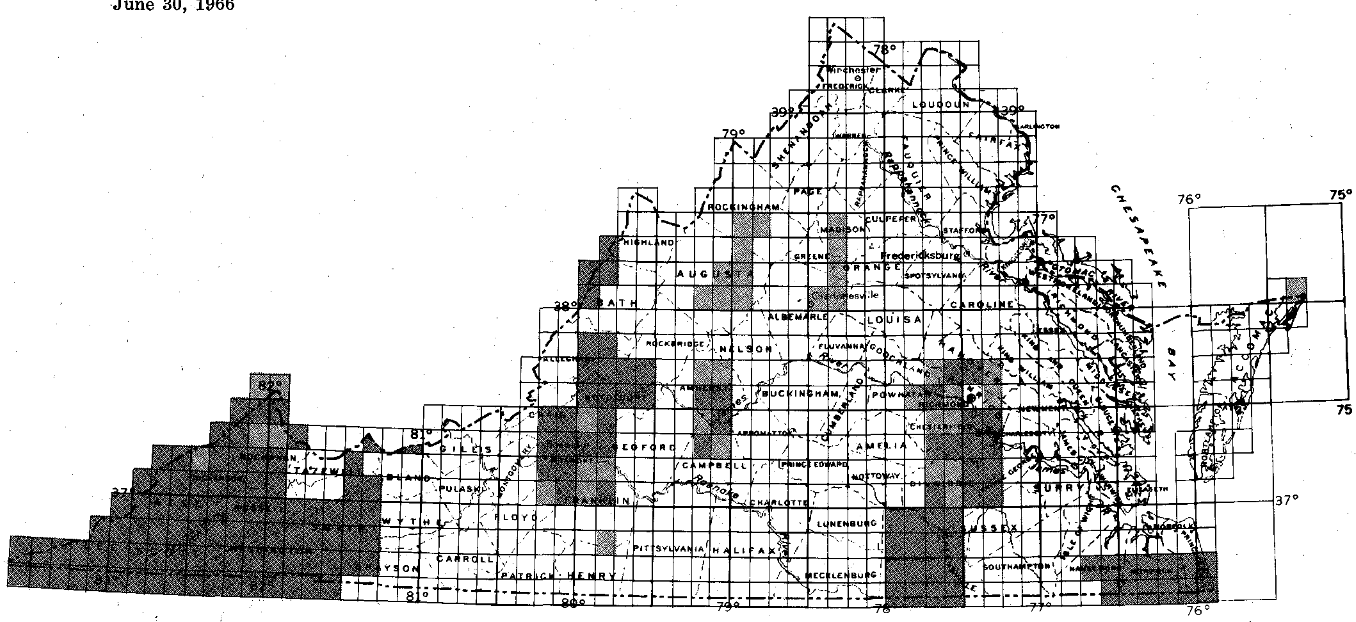
Box 3667

Charlottesville, VA 22903

Return Requested

PUBLISHED MAPS

- Adequate maps available prior to July 1, 1965
- Adequate maps published from July 1, 1965 to June 30, 1966



Areas where maps that conform to modern standards are available. Published maps are available at 30 cents each from the Virginia Division of Mineral Resources, Box 3667, Charlottesville, Va. 22903. A State index to topographic maps is available free.